INTELLEGENT TRANSMITTER RECEIVER SYSTEM AND ITS OPERATION METHOD

BACKGROUND OF THE INVENTION

The present invention relates to an intelligent transmitter receiver system and, more particularly to a simple, high-performance intelligent transmitter receiver system, which has the capability of copy-learning high-frequency remote controllers.

Regular receivers used in cars, motorcycles, rolling steel doors, etc., commonly have internal codes programmed therein. When the corresponding remote controller is lost, the user must go to the original supplier to check the internal codes of the cars, motorcycles, rolling steel doors, etc. In order to eliminate this problem, a user generally prepares multiple remote controllers (transmitters) for use with one receiver. When copying a remote controller, it needs special techniques and instrument, i.e., the case of a new remote controller must be opened at first so that a programmer can be connected to the bus line of the new remote controller for the input of the set frequency code into the new remote controller Only the persons skilled in the art can do the job.

Recently, remote controllers with a copy function have been developed, and have appeared on the market. This copy function enables the user to copy the frequency and code from one

remote controller to another. However, because frequency error is inevitable according to this copy function, it is necessary to correct the transmitting frequency by means testing the main unit after copy of the frequency and code. This frequency correction procedure takes much time. According to conventional methods, it scans from the lowest frequency level to the highest frequency level at a low speed when receiving external frequency. This scanning procedure takes several tends of seconds when copying the code of one key. Because the transmitting wave of an external remote controller is of intermittent type, a miss of scan may occur. In this case, the scanning action must be repeated again. It takes too much time when copying the codes of several function keys.

Because the transmitting wave of an external remote controller is of intermittent type, the code arrangement and density are different, as shown in FIG. 1a. According to the aforesaid code copy operation, the input of code must be started only after the input of frequency. The remote controller scans the external code signal from low frequency toward high frequency, and the scanning speed shouldn't be too fast. The transmitting frequency of regular remote controllers is within 0~500MHz. If the external frequency is 380MHz, the scanning speed is at 0.1MHz/0.1second. If the scanning speed is set faster, it cannot effectively scan the external frequency, as shown in FIG. 1b. Because a mixed frequency can be

produced only when matched with the wave of the external code and, because the waveform of the external remote controller is unstable, the scanning speed must be as slow as shown in FIG. 1c so that the correct frequency can be scanned and the wave of the external code can be matched to produce a mixed frequency. According to test, copying the code of a function key takes about 20 seconds. If the frequency of the external remote controller is 450MHz, it requires more than 20 seconds to complete the copy of the code of one function key. Further, because regular bandwidth of 100MHz surpasses the set bandwidth, it is necessary to manually change the pin positions in changing the bandwidth. When a mixed frequency not obtained at a first scan, a secondary scanning produce must be run.

Further, different external remote controllers have different frequency designs, for example, 300MHz in more US made remote controllers, 434MHz in most European remote controllers, or 200~500MHz in other areas. In order for different frequency copy requirements, the circuit board is provided with pins for manually changing the bandwidth. This complicates the copy operation.

SUMMARY OF THE INVENTION

The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide an intelligent transmitter receiver system, which can

copy the frequency and code of an external remote controller efficiently rapidly.

It is another object of the present invention to provide an intelligent transmitter receiver system, which uses a bandwidth extension switching circuit to extend the bandwidth of receivable range, eliminating the complicated conventional procedure of manually changing the pin positions in changing the bandwidth.

It is still another object of the present invention to provide an intelligent transmitter receiver system, which enables the CPU to drive the digital-to-analog converter to the high frequency transmitting circuit and the bandwidth extension switching circuit, to mix the internal oscillation frequency with the external serial signal after the signal receiving circuit has stored the code of the external remote controller in the memory, so that the code of the external remote controlled is copied at first and then the correction of the frequency of the code is achieved after the copy action.

It is still another object of the present invention to provide an intelligent transmitter receiver system, which drives the CPU to turn on the high frequency transmitting circuit to start wave mixing operation only after the full-frequency receiving circuit has successfully read the serial wave, so as to save power consumption and accelerate copy action.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic drawing showing the scanned wave and channel of a remote controller according to the prior art.

FIG. 2 is a circuit diagram of the present invention.

FIG. 3 is a circuit block diagram of the present invention.

FIG. 4 is a flowchart of the copy-learning mode according to the present invention.

FIG. 5 illustrates signal waveforms obtained according to the present invention.

FIG. 6 is a flowchart of the code-transmitting mode according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 2 and 3, an intelligent transmitter receiver system in accordance with the present invention comprises:

a CPU **C1** adapted to control instructions for the actions of code-transmitting mode and copy-learning mode;

a data-entry keys input circuit **K1** adapted to input signal into the CPU **C1**;

a DC battery circuit **B1** adapted to provide the necessary working power supply;

a DC voltage rectifier circuit **P1** adapted to electrically connect a DC battery circuit **B1** and convert the output power of the DC battery circuit **B1** into the necessary working voltage for the

other circuits of the intelligent transmitter receiver system when the push-button input circuit triggered;

a data-entry keys function switch **S1** adapted to switch the data-entry keys of the data-entry keys input circuit **K1** between two systems so as to multiply the functions of the data-entry keys;

a memory **M1** adapted to store code data obtained by the CPU **C1** and the center frequency value of the digital-to-analog converter **D1**;

an indicator lamp circuit **L1** adapted to indicate current operation mode subject to the instruction of the CPU **C1**, for example, to keep the indicator lamp constantly on when at the code-transmitting mode, or to flash the indicator lamp when at the copy-learning mode;

a digital-to-analog converter **D1** adapted to convert digital (parallel) signal into analog signal subject to the instruction of the CPU **C1**, so as to further drive a voltage-control type high-frequency transmitting circuit **T1** to change its output oscillation frequency;

a voltage-controlled type high frequency transmitting circuit **T1** adapted to transmit an oscillation frequency subject to the control of the CPU **C1** and the digital-to-analog converter **D1**;

a bandwidth extension switching circuit **T2** adapted to extend the bandwidth of the voltage-controlled type high frequency

transmitting circuit **T1** by 2~3 times.

a mixer circuit **R1** adapted to mix the wave from the internal high-frequency transmitting circuit **T1** with the wave from the external remote controller, enabling the signal to be outputted only when wave mixing achieved;

a signal amplifier **R2** adapted to amplify the signal from the mixer circuit **R1** or the signal from a full-channel receiving circuit **R3** into a digital serial signal receivable to the CPU **C1**; and

a full-channel signal receiving circuit **R3** adapted to receive external series signal and to output received series signal to the CPU **C1** for rapid center frequency correction.

The aforesaid bandwidth extension switching circuit **T2** comprises frequency switching diodes **PD1** and **PD2** for extending the original bandwidth by 2~4 times. The usable bandwidth shown in FIG. 1 is within 300~400MHz. By means of the operation of the frequency range extension switching circuit **T2**, the bandwidth is extended to 250~460MHz.

Referring to FIGS. from 2 through 4, when the user presses on the copy control key **K1** of the learning remote controller, the CPU **C1** drives the full-channel receiving circuit **R3** to judge if there is any signal from an external remote controller, and at the same time the indicator lamp circuit **L1** flashes, informing the user that the learning mode is in function. If there is no signal from an

external remote controller at this time, the full-channel receiving circuit **R3** keeps searching when the copy control key **K1** maintained depressed. When a control key signal from an external remote controller detected, the external code is read into the memory **M1** within 0.5 second. After the action of code reading, it enters the step of frequency auto-correction. At this time, the counting value of the digital-to-analog converter **D1** is zeroed (counting up from low frequency to high frequency), and the CPU **C1** reads serial signal from the full-channel receiving circuit **R3** (the full-channel receiving circuit **R3** receives a serial wave when there is an external transmission source). When the full-channel receiving circuit **R3** received a serial wave, the CPU **C1** goes to the high-frequency transmitting circuit **T1** and the frequency range extension switching circuit **T2** through the digital-to-analog converter **D1** to mix the provided oscillation frequency with the serial wave obtained from the external controller, and then goes to the mixer circuit **R1** and the signal amplifier **R2** to read the mixed serial signal. At this time, the CPU **C1** can also drives the signal amplifier **R2** to directly read the complete serial signal and store the signal in the memory **M1**.

When a mixed wave detected (i.e., the mixer circuit **R1** and the signal amplifier **R2** have a serial signal), it means that the oscillation frequency of the high-frequency transmitting circuit **T1**

is about equal to the signal from the external remote controller, and the CPU **C1** stores the value of the digital-to-analog converter **D1** by **fa**, as shown in FIG. 5, and then adds 20MHz to the frequency value of the digital-to-analog converter **D1**. The auto-correction action to correct the value from high frequency to low frequency is repeated until the production of a second mixed wave, i.e., obtaining the value **fb**. At final, the CPU **C1** sums up the value of **fa** and the value of **fb**, and then divided the sum by 2 to obtain the ,mean value for the center frequency of the external remote controller.

If no mixed wave is obtained, it repeats the aforesaid frequency auto-correction action.

When correcting (scanning) the frequency, the CPU **C1** reads the serial wave from the full-channel receiving circuit **R3**, and then turns on the voltage-controlled type high frequency transmitting circuit **T1** to start wave mixing operation. It saves power consumption because the voltage-controlled type high frequency transmitting circuit **T1** is not constantly turned on.

Under the functioning of the mixer circuit **R1**, the signal amplifier **R2**, the full-channel receiving circuit **R3**, the voltage-controlled type high frequency transmitting circuit **T1**, and the digital-to-analog converter **D1**, the wave mixing action is accurately achieved without waste of time, eliminating the

time-wasting drawback of the conventional blind scanning method of starting wave mixing action only when matched with the 0/1 intermittent serial wave of an external remote controller.

The 0/1 intermittent serial wave signal of an external remote controller has more than one thousands intermittent waves per second. The invention uses the full-channel receiving circuit **R3** to achieve wave mixing precisely. It takes less than 3 seconds to complete the copy and frequency auto-correction of the code data of one data-entry key. Therefore, the invention greatly improves the efficiency and convenience of the action of copy.

When entered the transmitting mode, as shown in FIG. 6, the CPU **C1** detects the triggering of the key switch **SW2, SW3, SW4,** or **SW5** of the data-entry keys input circuit **K1**, and then fetches the corresponding code data and transmitting frequency value from the memory **M1**, and then turns the indicator lamp of the indicator lamp circuit **L1** into the state of constantly on to indicate the current transmitting mode, and then outputs the fetched transmitting frequency value to the digital-to-analog converter **D1** and the frequency range extension switching circuit **T2**, so as to further output the code data to the voltage-controlled type high frequency transmitting circuit **T1**, enabling the assigned frequency to be transmitted to the main unit to control the rolling steel door, car lock, motorcycle lock, etc.

In order to save key space and to minimize the remote controller dimensions, the data-entry keys function switch **S1** is provided, as shown in FIG. 2. When switching the data-entry keys function switch **S1** from a first position to a second position, the data-entry keys are shifted to a second control system. By means of switching the data-entry keys function switch **S1**, the data-entry keys are shifted between two control systems.

As indicated above, the present invention greatly expands the scanning bandwidth. By means of the action of reading the code at the first time and then automatically correct the frequency, the invention is free from the limitation of the external bandwidth.

Although a particular embodiment of the invention has been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.